

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of) Attorney Docket No.: MIYOSH0008
Seiichi AKAGI et al.)
Serial No.: 10/598,515) Confirmation No.: 6701
Filed: September 1, 2006) Group Art Unit: 1796
For: SEALANT EPOXY-RESIN MOLDING)
MATERIAL, AND ELECTRONIC)
COMPONENT DEVICE) Examiner: Hannah J. PAK

DECLARATION UNDER 37 C.F.R. § 1.132

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U.S. Patent and Trademark Office
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Randolph Building
401 Dulany Street
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Sir:

1. I, Ryouichi IKEZAWA, the undersigned, state that I am a co-inventor of the subject matter of the above-captioned application, and an expert in the field of the above-captioned application as evident from my Curriculum Vitae, a copy of which is attached herewith as "Exhibit A1."

2. I am familiar with the above captioned application and claims. A copy of the presently pending claims are attached herewith as an Appendix. I have also reviewed the Office Action mailed March 30, 2009 in the above-captioned application. I am also familiar with the subject matter disclosed by JP 05-283560 (hereafter, the "Nakamura Document") because I have reviewed this document. In this declaration, I submit my expert opinion regarding the following: (i) the scope of subject matter disclosed by the Nakamura Document; and (ii) the fact that the compound disclosed by Formula 9 of the Nakamura Document pertains to a

completely different class of compounds, in terms of structure and chemistry, than those recited by General Formula (I) of claim 1 of the above-captioned application; and (iii) the fact that the Nakamura Document does not teach, or suggest, a compound according to General Formula (I) of claim 1 of the above-captioned application.

3. In rendering my opinion I have considered (a) the contents of the specification and claims of the above-captioned application (as amended by Amendment (B), filed December 15, 2008, wherein a copy of the amended claims is reproduced below in the attached Appendix), (b) the contents of the Nakamura Document, of record, (c) the contents of the Office Action dated March 30, 2009, of record, (d) the contents of English Machine translation of the Nakamura Document, downloaded from Japanese Patent Office database on August 5, 2008, of record as "Exhibit A," (e) the contents of <http://stneasy-japan.cas.org/tmp/20031110/174338-1056700614-300/409740480.html>, downloaded on November 11, 2003, of record as "Exhibit B," (f) a copy of STN Tokyo database search results, three pages, of record as "Exhibit C," and (g) a copy of page 85 of HAWLEY'S CONDENSED CHEMICAL DICTIONARY (1987), which is filed herewith as "Exhibit A2," which are sources of information an expert in my field would reasonably rely upon in rendering an opinion regarding the subject matter of this declaration.

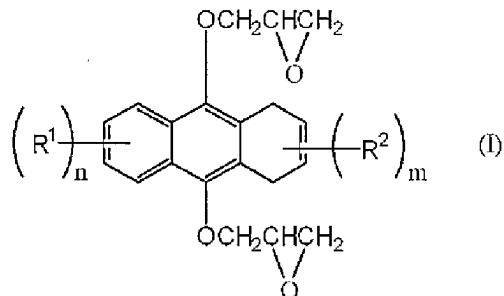
4. Based on my own knowledge and experience in the art, and my review of the materials referenced above, it is my opinion that the Nakamura Patent discloses a compound in Formula 9 known by the chemical name 2,2'-[9,10-anthracenediylbis(oxymethylene)]bis-oxirane, which is a substantially different compound from that of General Formula (I) of independent claim 1 of the above-captioned application. The basis for my opinion are fully explained below.

The Invention

5. The invention of the above-captioned application pertains broadly to a sealant epoxy-resin molding material, such as may be used to seal electronic component devices. In accordance with an embodiment of the present invention, a sealant epoxy-resin molding material is provided that has features recited by independent claim 1. Various other embodiments, in accordance with the present invention, are recited by the dependent claims.

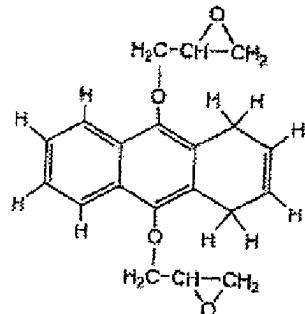
6. An advantage provided by the various embodiments, in accordance with the present invention, is that a sealant epoxy-resin molding material is provided that is flame retardant and that also has good characteristics with respect to moldability, reflow resistance, and moisture resistance, and that can undergo high-temperature storage. Another advantage provided by a sealant epoxy-resin molding material of the present invention is that the material is a non-halogenated, non-antimony containing flame retardant.

7. A sealant epoxy-resin molding material, in accordance with independent claim 1 of the above-captioned application, comprises an epoxy resin (A) that contains a compound represented by the following General Formula (I):



wherein in General Formula (I), R¹ represents a group selected from substituted or unsubstituted hydrocarbon groups having 1 to 12 carbon atoms and substituted or unsubstituted alkoxy groups having 1 to 12 carbon atoms, and the groups R¹ may be the same as, or different from, each other; n is an integer of 0 to 4; R² represents a group selected from substituted or unsubstituted hydrocarbon groups having 1 to 12 carbon atoms and substituted or unsubstituted alkoxy groups having 1 to 12 carbon atoms, and the groups R² may be the same as, or different from, each other; and m is an integer of 0 to 6.

8. As evident from General Formula (I), when m = n = 0, the compound of General Formula (I) has the following chemical formula:



I believe that a person of ordinary skill in the art would instantly realize that the compound of General Formula (I), where m = n = 0, corresponds to CAS Registry Number: 848667-77-6, as evident from the STN Tokyo database search results of record as "Exhibit C," and has the

chemical name of 1,4-dihydro-9,10-anthracenediol, and is a polymer with (chloromethyl) oxirane. The compound of General Formula (I), where m = n = 0, is a three ring structure, and a person of ordinary skill in the art would instantly appreciate that the third ring is dihydrogenated.

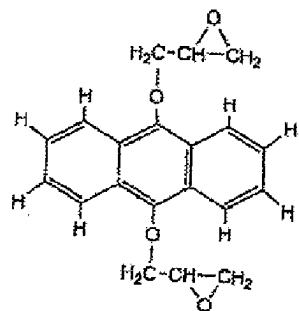
The Nakamura Document

9. The Nakamura Document discloses an epoxy resin composition for semiconductor closure, wherein 9,10-dihydroxyanthracene is reacted with epichlorohydrin to produce a compound having the structural formula shown in Formula 9 shown below (Nakamura Document, ¶¶ [0001] and [0044], see also Exhibit A, of record). I believe that a person of



[Formula 9]

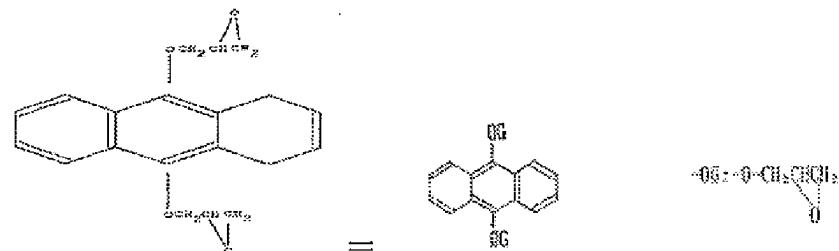
ordinary skill in the art would instantly realize that the compound of Formula 9 corresponds to CAS Registry Number: 155665-67-1 (See, e.g., <http://stneasy-japan.cas.org/tmp/20031110/174338-1056700614-300/409740480.html>, downloaded on November 11, 2003, of record as "Exhibit B"), and has the chemical name 2,2'-(9,10-anthracenediyl)bis(oxymethylene)bis-oxirane, and the following chemical structure:



I believe a person of ordinary skill in the art would instantly realize that the compound disclosed by the Nakamura Document as "Formula 9" is an anthracene compound that has its third ring conjugated.

Comparison of General Formula (I) and Formula 9

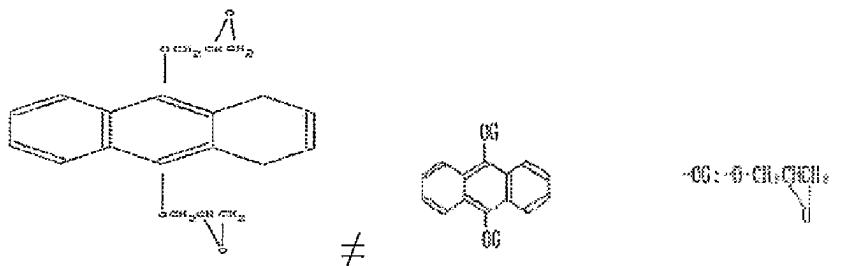
10. I understand that the Examiner has mistranscribed the compound of Formula 9 of the Nakamura Document into the Office Action mailed March 30, 2009, at 4. The Examiner erroneously contents that



I believe that a person of ordinary skill in the art would immediately see that the Examiner's contention is false because the compound on the left (Examiner's drawing) is a dihydrogenated or reduced anthracene compound and the compound on the right (Formula 9

of the Nakamura Document) is an anthracene compound. Exhibit A2 filed herewith is page 85 of HAWLEY'S CONDENSED CHEMICAL DICTIONARY (1987), and demonstrates the structural formula of anthracene.

11. In other words, a person of ordinary skill in the art would realize that



because the compound of Formula 9 of the Nakamura Document is an anthracene compound and the compound written on the top portion of page 4 of the March 30, 2009 Office Action is a dihydrogenated or reduced anthracene compound. The compound drawn on page 4 of the March 30, 2009 Office Action is a compound in accordance with General Formula (I) of claim 1 of the above-captioned application when $m = n = 0$. So, in my opinion, the Examiner has clearly demonstrated that a compound in accordance with General Formula (I), in accordance with claim 1 of the above-captioned application, is structurally a substantially different compound from the anthracene compound of Formula 9 of the Nakamura Document.

Different Chemistries of a Compound of Nakamura's Formula 9 and a Compound of General Formula (I) of the Invention

12. For all of the above reasons, I conclude that a person of ordinary skill in the art would instantly realize that the compound employed by the present invention, as recited by

independent claim 1, is a dihydrogenated or reduced anthracene compound and is a substantially different compound from the anthracene compound of Nakamura's "Formula 9." This fact is also supported by the fact that the Chemical Abstracts Society's (CAS) separately catalogues these compounds.

13. It is an additional fact that these two substantially different compounds are synthesized differently. For example, based on my knowledge and experience in the art, I believe the compound represented by General Formula (I) can be synthesized/manufactured with ease. On the other hand, I believe the synthesis of a compound of Nakamura's Formula 9 is more difficult because its precursor compound is unstable and easily oxidized. Consequently, I believe it is difficult to manufacture the compound of Nakamura's Formula 9 on an industrial level, although it is possible to synthesize the compound of Nakamura's Formula 9 when performed on a smaller scale in a laboratory. In my opinion, the fact that the compound of General Formula (I) may be synthesized in large amounts, whereas the compound of Nakamura's Formula 9 must be synthesized in smaller batches due to the instability of the precursor compound, is additional evidence showing that the compound of General Formula (I) is not the same compound as that of Nakamura's Formula 9 because their chemistries are different.

14. In addition, the effect of the present invention is substantially different from that of the compounds of Nakamura's disclosure. As described in ¶ [0008] of the original specification of the above-captioned application, a non-halogenated, non-antimony sealant epoxy-resin molding material contains a compound of "General Formula (I)" and is superior in flame resistance while retaining desired properties with respect to moldability, reflow resistance, moisture resistance and high-temperature storage. On the other hand, the

Nakamura Document discloses that the epoxy resin disclosed therein contains an anthracene compound, as shown by Formula 9, and exhibits resistance to a temperature cycle test ("TCT"), and crack resistant characteristics. However, Nakamura's objectives are substantially different ones from those of the presently claimed invention, which includes achieving flame resistance. Furthermore, the Nakamura Document discloses that "[c]oupling agents, such as fire retardant, such as antimonous oxide and the phosphorous system compound, paints, a silane coupling agent, etc." can be included in the epoxy resin composition (See Nakamura Document, ¶ [0029], and Exhibit A, ¶ [0029]). In other words, I conclude that the Nakamura Document does not teach, or even suggest, the use of its anthracene compound of Formula 9 as a flame retardant.

Summary

15. It is my opinion, based on the materials and evidence I have considered, that:

- a. the compound of Formula 9 of the Nakamura Document pertains to an anthracene compound that is not known to have any flame retardant properties;
- b. the compound of General Formula (I), as recited in independent claim 1 of the above-captioned patent application, is not an anthracene compound but is a dihydrogenated or reduced anthracene compound;
- c. the compound of Formula 9 of the Nakamura Document and the compounds of General Formula (I) recited by claim 1 of the above-captioned application are substantially different compounds with substantially different chemistries; and

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- d. based on my review of the Office Action, mailed March 30, 2009, I conclude that the Examiner misrepresents the structural formula of Formula 9 of the Nakamura Document on page 3, line 17, to page 4, line 1, of the March 30th, 2009 Office Action.

16. I declare under penalty of perjury that the foregoing is true and correct, that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

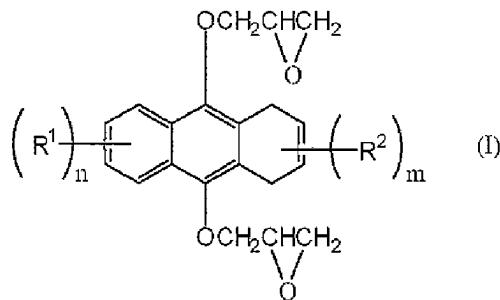
Signed by,

Date: July 22, 2009.

Ryouichi Ikezawa.
Ryouichi IKEZAWA

APPENDIX (CLAIMS):

1. A sealant epoxy-resin molding material, comprising an epoxy resin (A) and a hardening agent (B), wherein the epoxy resin (A) contains a compound represented by the following General Formula (I):



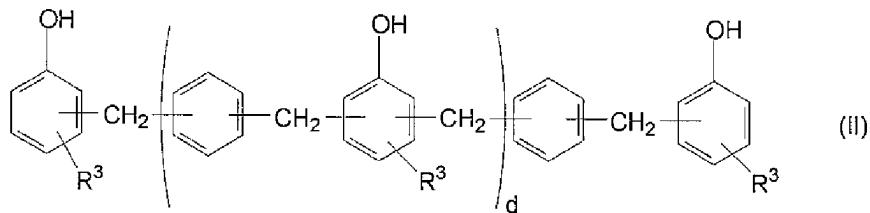
wherein in General Formula (I), R¹ represents a group selected from substituted or unsubstituted hydrocarbon groups having 1 to 12 carbon atoms and substituted or unsubstituted alkoxy groups having 1 to 12 carbon atoms, and the groups R¹ may be the same as, or different from, each other;

n is an integer of 0 to 4;

R² represents a group selected from substituted or unsubstituted hydrocarbon groups having 1 to 12 carbon atoms and substituted or unsubstituted alkoxy groups having 1 to 12 carbon atoms, and the groups R² may be the same as, or different from, each other; and

m is an integer of 0 to 6.

2. The sealant epoxy-resin molding material according to Claim 1, wherein the hardening agent (B) contains a compound represented by the following General Formula (II):



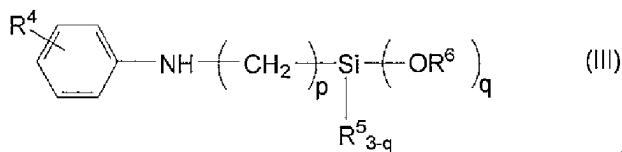
wherein R^3 represents a group selected from a hydrogen atom and substituted or unsubstituted monovalent hydrocarbon groups having 1 to 10 carbon atoms; and
 d is an integer of 0 to 10.

3. The sealant epoxy-resin molding material according to Claim 1, further comprising a hardening accelerator (C).
4. The sealant epoxy-resin molding material according to Claim 3, wherein the hardening accelerator (C) is triphenylphosphine.
5. The sealant epoxy-resin molding material according to Claim 3, wherein the hardening accelerator (C) is an adduct of a tertiary phosphine compound and a quinone compound.
6. The sealant epoxy-resin molding material according to Claim 1, further comprising an inorganic filler (D).
7. The sealant epoxy-resin molding material according to Claim 6, wherein the content of the inorganic filler (D) is 60 to 95 wt % with respect to the sealant epoxy-resin molding material.
8. The sealant epoxy-resin molding material according to Claim 6, wherein the content of the inorganic filler (D) is 70 to 90 wt % with respect to the sealant epoxy-resin molding material.

9. The sealant epoxy-resin molding material according to Claim 1, further comprising a coupling agent (E).

10. The sealant epoxy-resin molding material according to Claim 9, wherein the coupling agent (E) contains a secondary amino group-containing silane-coupling agent.

11. The sealant epoxy-resin molding material according to Claim 10, wherein the secondary amino group-containing silane-coupling agent contains a compound represented by the following General Formula (III):



wherein R^4 represents a group selected from a hydrogen atom, alkyl groups having 1 to 6 carbon atoms, and alkoxy group having 1 to 2 carbon atoms;

R^5 represents a group selected from alkyl groups having 1 to 6 carbon atoms and a phenyl group;

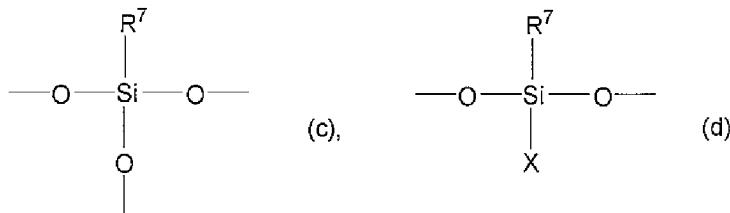
R^6 represents a methyl or ethyl group;

p is an integer of 1 to 6; and

q is an integer of 1 to 3.

12. The sealant epoxy-resin molding material according to Claim 1, wherein the epoxy resin (A) and the hardening agent (B) are melt-mixed previously.

13. The sealant epoxy-resin molding material according to Claim 1, further comprising a silicon-containing polymer (F) having the following bonds (c) and (d),



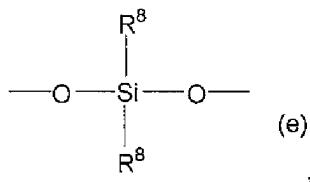
a terminal selected from R⁷, a hydroxyl group and alkoxy groups, and an epoxy equivalence of 500 to 4,000,

wherein R⁷ represents a group selected from substituted or unsubstituted monovalent hydrocarbon groups having 1 to 12 carbon atoms;

the groups R⁷ in the silicon-containing polymer may be the same as, or different from, each other; and

X represents an epoxy group-containing monovalent organic group.

14. The sealant epoxy-resin molding material according to Claim 13, wherein the silicon-containing polymer (F) has the following bond (e) additionally:



wherein R⁸ represents a group selected from substituted or unsubstituted monovalent hydrocarbon groups having 1 to 12 carbon atoms; and

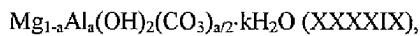
the groups R⁸ in the silicon-containing polymer may be the same, as or different from, each other.

15. The sealant epoxy-resin molding material according to Claim 13, wherein the softening temperature of the silicon-containing polymer (F) is 40°C or higher and 120°C or lower.

16. The sealant epoxy-resin molding material according to Claim 13, wherein R⁷ in the silicon-containing polymer (F) is at least one of a substituted or unsubstituted phenyl group and a substituted or unsubstituted methyl group.

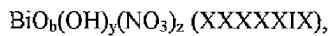
17. The sealant epoxy-resin molding material according to Claim 13, wherein the rate of substituted or unsubstituted phenyl groups having 1 to 12 carbon atoms in all groups R⁷ in the silicon-containing polymer (F) is 60 to 100 mol %.

18. The sealant epoxy-resin molding material according to Claim 1, further comprising at least one of a compound (G) represented by Compositional Formula (XXXXIX) and a compound (H) represented by the following Compositional Formula (XXXXXIX):



wherein $0 < a \leq 0.5$; and

k is a positive number), and

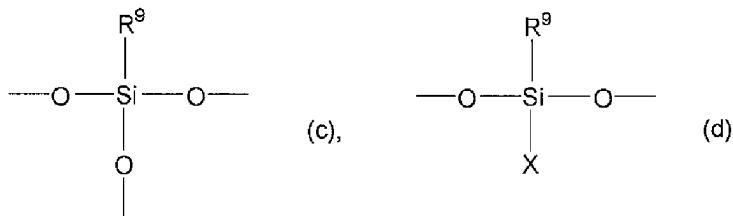


wherein $0.9 \leq b \leq 1.1$, $0.6 \leq y \leq 0.8$, and $0.2 \leq z \leq 0.4$.

19. An electronic component device, comprising an element sealed with the sealant epoxy-resin molding material according to Claim 13.

20. The sealant epoxy-resin molding material according to Claim 6, further comprising a coupling agent (E).

21. The sealant epoxy-resin molding material according to Claim 20, further comprising a silicon-containing polymer (F) having the following bonds (c) and (d),



a terminal selected from R⁹, a hydroxyl group and alkoxy groups, and an epoxy equivalence of 500 to 4,000,

wherein R⁹ represents a group selected from substituted or unsubstituted monoivalent hydrocarbon groups having 1 to 12 carbon atoms;

the groups R⁹ in the silicon-containing polymer may be the same as, or different from, each other; and

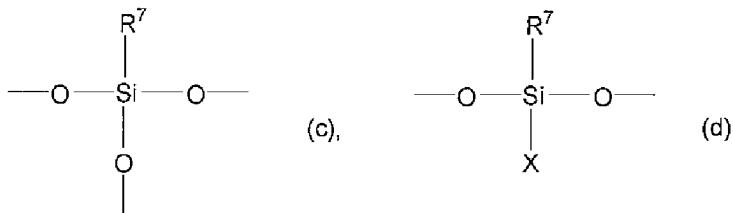
X represents an epoxy group-containing monoivalent organic group.

22. The sealant epoxy-resin molding material according to Claim 3, further comprising an inorganic filler (D).

23. The sealant epoxy-resin molding material according to Claim 3, further comprising a coupling agent (E).

24. The sealant epoxy-resin molding material according to Claim 3, wherein the epoxy resin (A) and the hardening agent (B) are melt-mixed previously.

25. The sealant epoxy-resin molding material according to Claim 3, further comprising a silicon-containing polymer (F) having the following bonds (c) and (d),



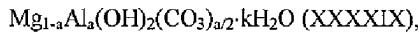
a terminal selected from R⁷, a hydroxyl group and alkoxy groups, and an epoxy equivalence of 500 to 4,000,

wherein R⁷ represents a group selected from substituted or unsubstituted monovalent hydrocarbon groups having 1 to 12 carbon atoms;

the groups R⁷ in the silicon-containing polymer may be the same as or different from each other; and

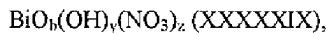
X represents an epoxy group-containing monovalent organic group.

26. The sealant epoxy-resin molding material according to Claim 3, further comprising at least one of a compound (G) represented by Compositional Formula (XXXXIX) and a compound (H) represented by the following Compositional Formula (XXXXXIX):



wherein $0 < a \leq 0.5$; and

m is a positive number), and



wherein $0.9 \leq b \leq 1.1$, $0.6 \leq y \leq 0.8$, and $0.2 \leq z \leq 0.4$.

CURRICULUM VITAE FOR RYOUICHI IKEZAWA

EDUCATION:

Master's Degree in Polymer Chemistry, Sophia University, 1988.

WORK HISTORY:

Staff Researcher in Semiconductor Materials Division, R&D Group, Hitachi Chemicals, Ltd., employed with Hitachi Chemicals Ltd. since 1988.

- Mr. Ikezawa's work pertains to the research and development of compositions of molding materials. The molding materials are used as a sealant for an electronic component, such as a semiconductor.